

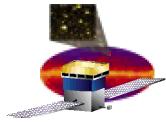


GLAST Large Area Telescope Calorimeter Subsystem Functional / Performance Testing

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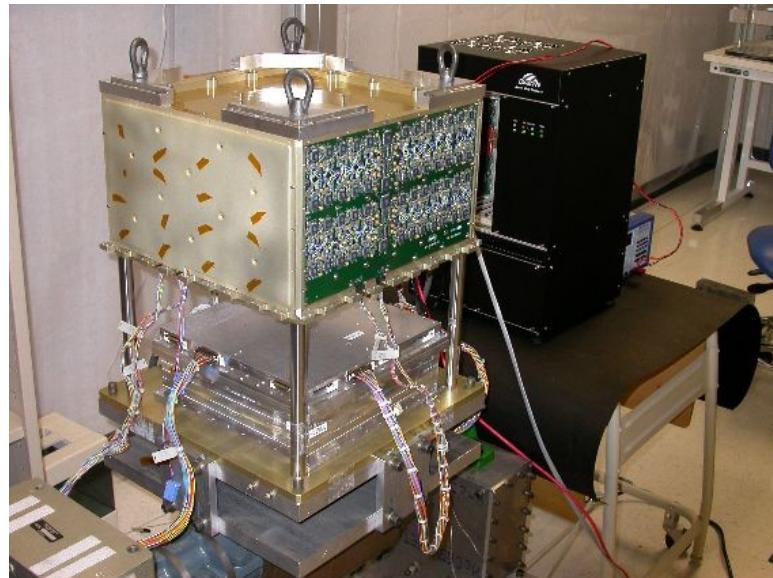




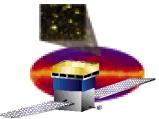
Functional Testing and Calibration

- Module-level functional and performance testing

EM CAL during
Functional test



- Functional testing addressed in LAT-MD-01370
 - Defines comprehensive and limited tests (CPT, LPT)
- Calibration is addressed in LAT-MD-04187
 - Defines electronic (ECS) and muon calibration (MuC)



Functional Requirements and Traceability

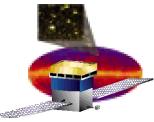
□ Requirements

- Relevant, testable requirements extracted from Level III and Level IV specs
- Verification matrix in LAT-MD-01374

□ Traceability

- Functional test suites generate test report summarizing results and compliance with relevant specifications
 - Pass/fail overall and by test element
- Traceability maintained element-by-element through LAT-SS-01502

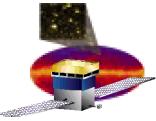




Functional Test Flow

- **Comprehensive Functional and Performance Test (CPT)**
 - **Test suite composed of 22 elements with following goals**
 - Verify full functionality of all CAL registers and proper communication with TEM
 - Measure pedestal centroids and widths
 - Verify stability of optical bonds for all CDEs
 - Measure electronic gain, linearity, and integral non-linearity of each GCFE
 - Characterize low and high energy (FLE and FHE) discriminators
 - Characterize zero-suppression (LAC) threshold DAC
 - Characterize auto-ranging (ULD) discriminator DAC
 - Estimate event dead-time
 - Test overload recovery circuitry
 - **Suite executes complete test sequence without user intervention**
 - Run time ~ 2 hours

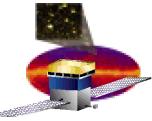




Functional Test Flow (cont.)

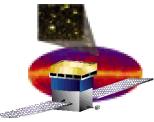
- **Limited Functional and Performance Test (LPT)**
 - **Test suite composed of 6 elements with following goals:**
 - Verify functionality of all CAL registers and proper communication with TEM
 - Measure pedestal centroids and widths
 - Verify stability of optical bonds for all CDEs
 - **Suite executes complete test sequence without user intervention**
 - Run time ~ 15 minutes





Calibration Flow

- **Electronic Calibration (ECS)**
 - **Test suite to give detailed calibrations of**
 - Electronic gain, linearity, and integral non-linearity of each GCFE
 - Low and high energy (FLE and FHE) discriminators
 - Zero-suppression (LAC) threshold DAC
 - Auto-ranging (ULD) discriminator DAC
- **Muon Calibration (MuC)**
 - **Calibrates “optical gain” of each CDE**
 - Optimizes time delay between trigger and peak hold
 - Verifies calibration (energy units) in FLE/FHE from ECS
 - Fits muon peak (with its known energy deposition), gives MeV/bin.
 - Maps light taper and light asymmetry in each CDE
- **These calibrations are run at start and end of environmental test program**
 - **Reference calibration just prior to shipment to SLAC**



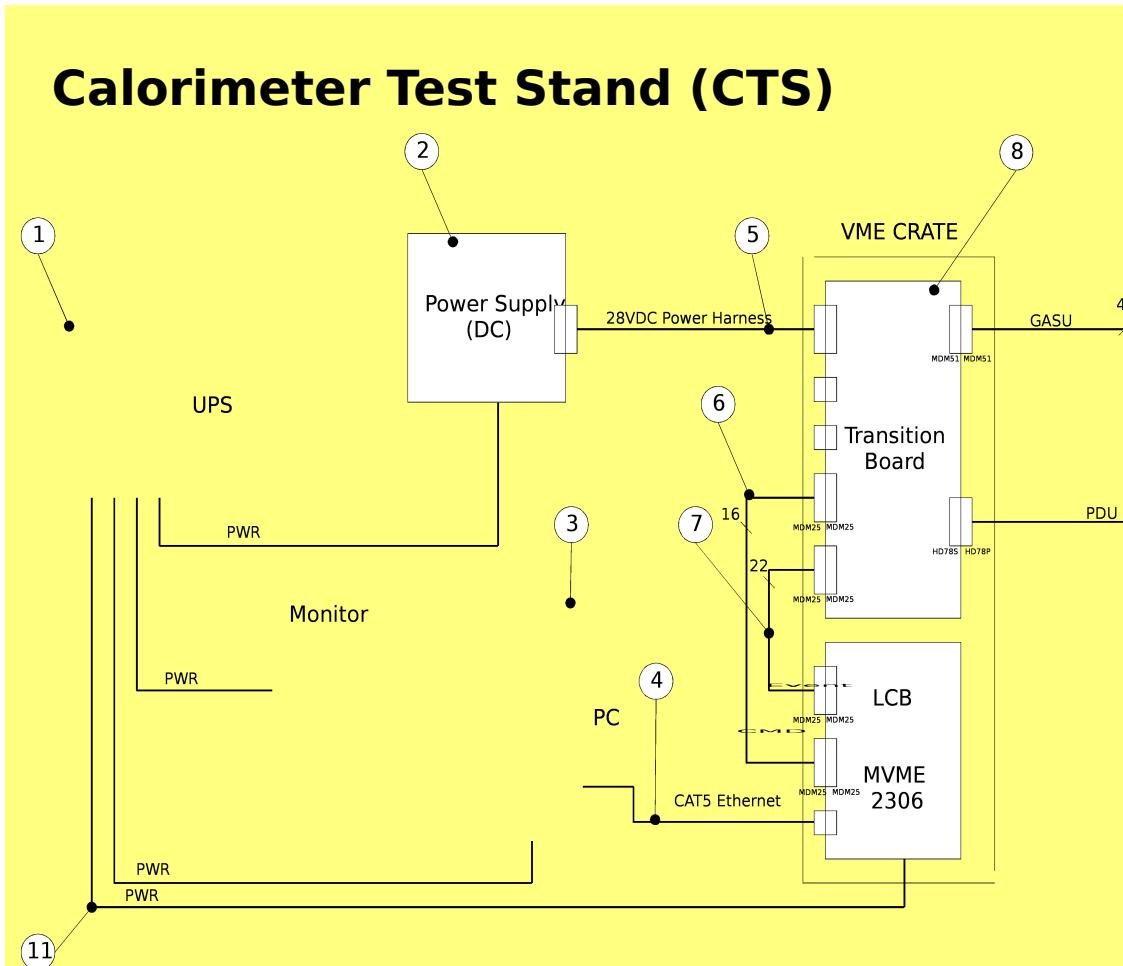
Functional Testing to Date

- **Engineering Model CAL Module**
 - Full suite of functional tests and calibrations conducted through environmental test program
 - Gave opportunity to practice and/or redefine algorithms and flow of test suite
 - Demonstrated compliance with performance specifications

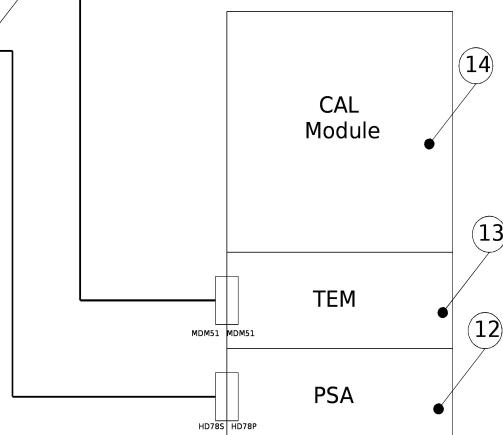
- **Flight Component Testing**
 - Flight AFEE board-level testing uses essentially identical test suite
 - Last opportunity to refine suite for Module-level test
 - Testing in progress



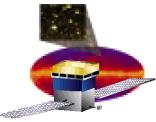
CAL Module Functional Test Configuration



CAL Tower Module



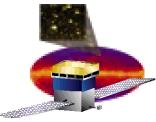
LAT-DS-01960-01



Functional Test Facility Status

- TEM/TPS (version EM2)
 - How many?
 - 8 units exist at NRL for use with FM CAL Modules
 - 1 is verified for environmental test
 - 7 are under receiving/workmanship test
 - » 3 will be returned to SLAC (1 comm prob, 2 connector damage)
- Calorimeter Test Stand
 - How many?
 - 13 exist at NRL
 - 6 are in simultaneous use during nominal Module A&T program
 - 5 are in simultaneous use for TEM and AFEE testing
- Scenario
 - TEM/TPS attached to CAL Module
 - Ships to SLAC, but must return ASAP
 - CTS dedicated to each test area (e.g. vibe, TVAC)
 - CAL Tower Module moves in, tests, moves out
- Status
 - Ready to go





Test Software Status

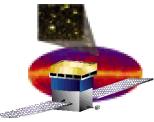
□ Configuration Management

- LATTE 4 is controlled by LAT I&T at SLAC
- CAL Scripts are configured at NRL (CVS) with releases to SLAC CVS
 - Script suites are in use at NRL
- Documentation
 - LAT-MD-01370, CPT and LPT
 - LAT-MD-04187, ECS and MuC
 - LAT-TD-01502, test descriptions

□ Status

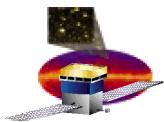
- CAL scripts run successfully under LATTE 3-02
- CAL scripts still being verified against latest LATTE release
- FMA test will proceed with LATTE 3-02





Known Risks and Limitations

- **Functional test (and calibration) uses EM2 TEM and TPS**
 - **May not reflect actual performance of the flight TEM/TPS**
 - **Fewer TEM/TPS than CAL Modules**
 - **Too few??**
 - **TEM/TPS must return to NRL for reuse ASAP**
- **LATTE and CAL package not yet frozen**
 - **LATTE current rev: 4-01**
 - **CAL runs at NRL with LATTE v. 3-02**
 - **NRL and SLAC have agreement to work together to get stable s/w system**
 - **NRL and SLAC s/w systems will be different for FMA**



Functional Test Status

ITEM	STATUS
Requirements	Defined
Pass-Fail Criteria	Defined
Testing to Date	EM successful
Configuration	Defined
Handling/Installation	Defined
Facility Status	S/W scripts being verified against current rev of LATTE
Test Equipment	Ready
Risks and Limitations	<ol style="list-style-type: none">1. Test and calibration use EM2 TEM/TPS2. TEM/TPS must return to NRL ASAP3. S/W not yet frozen
Procedures	Configured
Status	System is ready to execute tests

Washington DC

